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EXAMINER	
NGUYEN, KIMBINH T	

ART UNIT	PAPER NUMBER
2671	9

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/017,148	Applicant(s) JENNINGS ET AL.	
	Examiner Kimbinh T. Nguyen	Art Unit 2671	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 May 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12,14-39 and 41-58* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,14-39 and 41-58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date 7.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to amendment filed 5/17/04.

2. Claims 13 and 40 have been canceled; the new claims 57 and 58 have been added. Accordingly, claims 1-12, 14-39, 41-58 are pending in the application.

3. The Information Disclosure Statement filed 01/26/04 has been entered.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 57 and 58 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter "the non-volumetric representation comprises a selected one of a point cloud, a particle system and a collection of curves" which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-9, 12, 14-21, 24-36, 39, 41-48, 53-56 are rejected under 35 U.S.C. 102(e) as being anticipated by Shih et al. (6,552,722).

Claim 1, Shih et al. clearly anticipated representing a virtual object as a volumetric model (virtual object 26 is a volumetric representation; col. 2, lines 48-49; col. 3, lines 32-33; fig. 2A); converting a subset of the volumetric model (the virtual object 26 is implemented as a volume using concepts of voxels 78, density, and an isosurface 86; col. 17, lines 5-7) into a non-volumetric representation (a non-volumetric representation is a surface, an isosurface 86, the virtual surface 25 or polygon of a virtual object: converting the object to an exported surface such as a polygonal surface; col. 2, lines 58-60; the exported surface is a geometry consisting of one or more NURBS; col. 2, lines 63-65); modifying the non-volumetric representation according to a stimulus (modifications to the isosurface 86 are made indirectly, by modification of the voxel density values, based on the virtual tool 28 (haptic interface (stimulus) location relative to the isosurface 86; col. 30, lines 52-56); modifying the volumetric model so as to substantially represent the modified non-volumetric representation (the density values of the virtual object 26 are then modified based on the comparison with the tool density values and the modification model, resulting in a modification to the isosurface 86 that appears as removal of material; col. 30, line 63 through col. 31, line 5).

Claim 2, Shih et al. discloses modifying the non-volumetric representation according to a first stimulus (a modification mode that modifies a voxel value (non-volumetric) representative of the voxel based virtual object; col. 41, lines 35-36) and

further modifying a non-volumetric representation according to a second succeeding stimulus (the modification is selected one of a material removal mode, a material addition mode, a smoothing mode, a mirroring mode, and a 3D sketch mode (stimulus by virtual tool); col. 42, lines 50-53).

Claim 3, Shih discloses modifying the volumetric model comprises a change in shape of the volumetric representation (col. 11, lines 38-55).

Claim 4, Shih discloses converting a response of the non-volumetric representation to the stimulus into a response of the volumetric model to the stimulus (interfacing with a virtual object in a haptic virtual environment; col. 3, line 64 through col. 4, line 10).

Claims 5-8, Shih discloses the subset of the volumetric model is a portion of the volumetric model (voxel 78 and surface 86; col. 18, line 8); the volumetric model comprises voxels (col. 18, lines 47-53); values spaced in a 3D grid (col. 18, lines 3-4).

Claims 9, Shih discloses the non-volumetric representation comprises a surface (col. 3, line 44).

Claim 12, Shih teaches the non-volumetric representation comprises a selected one of a polygon set (polygonal surface; col. 3, line 44), a bezier surface, a b-spline surface (col. 3, lines 49-50), a procedural surface, a NURBS (col. 20, lines 59-60).

Claims 14-16, Shih teaches the stimulus is a stimulus from a user using a haptic interface which is a feedback interface has three degrees of force feedback (col. 10, lines 48-60).

Claim 17, Shih teaches displaying the virtual object on a computer display (col. 3, lines 24-25; col. 7, lines 11-14; col. 41, line 51; fig. 18, # 418).

Claim 18, Shih discloses the volumetric model and non-volumetric representations comprise representations having different numbers of dimensions (col. 36, line 62 through col. 37, line 4).

Claims 19, 20, Shih discloses the stimulus comprises at least one of a displacement function (penetration distance; col. 19, lines 15-17; col. 26, lines 1-10), a smoothing function (col. 34, line 60; col. 36, lines 36-58), a volumetric interference, an areal interference (a collision between a virtual tool and a virtual object; col. 20, lines 53-58), a result of simulation (col. 33, lines 33-39), a control point modification (col. 29, lines 60-62; col. 31, lines 50-56), a data re-fitting, and a force (col. 29, lines 63-67; col. 30, lines 7-24); the stimulus is applied to the object in real-time (moving in a continuous motion; col. 31, lines 45-46).

Claim 21, Shih discloses transforming the non-volumetric representation (virtual surface for the voxel-based virtual object) into a third representation (virtual tool); modifying the third representation in response to an applied stimulus (the user may rely on haptic feedback when modifying the object; col. 2, lines 12-20); transforming (applying interaction force (penetration) among the constraint geometry) the modified third representation (virtual tool) to a modified volumetric representation (the voxel-based virtual object), col. 41, lines 41-50.

Claim 24, Shih discloses applying a feedback force to a user, the feedback force being generally consistent with a geometric shape of a modified virtual object (col. 38, lines 10-40).

Claim 25, the rationale provide in the rejection of claims 1 and 6 is incorporated herein.

Claims 26, 55, the rationale provided in the rejection of claim 19 is incorporated herein.

Claims 27, 56, the rationale provided in the rejections of claims 9 and 25 are incorporated herein.

Claims 28-36, 39, 41-48, 53 and 54 disclose a system having claimed elements the same as claims 1-9, 12-21, 24, 25 and are rejected under the same reasons set forth in claims 1-9, 12-21, 24, 25.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. Claims 10, 11, 22, 23, 37, 38 and 49-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shih et al. (6,552,722) in view of Tarr (6,191,796).

Claims 10, 37, Shih et al. does not teach triangle representations; however, Tarr (6,191,796) teaches the non-volumetric representation (the virtual surface) comprises a

set of triangles representation (col. 22, lines 40-43; fig. 12D). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the triangular representation as taught by Tarr into the sculpting virtual object in a haptic virtual reality environment of Shih's system for modifying the virtual object, because it would provide a method for haptically deforming a virtual surface within a haptic virtual environment (col. 2, lines 3-4).

Claims 11, 38, 52, Shih et al. does not teach a weighted displacement function; however, Tarr teaches the stimulus comprises a weighted displacement function (penetrating vertex: the magnitude of the distance) defined on vertices of the set of triangles (vertices of the triangular mesh forming the virtual surface; col. 15, lines 10-64; col. 32, lines 43-67). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the weighted displacement function (penetrating vertex: the magnitude of the distance) defined on vertices of the set of triangles as taught by Tarr into the sculpting virtual object in a haptic virtual reality environment of Shih's system for modifying the virtual object, because it would provide surface interaction process to find a vertex of the triangle mesh forming the virtual surface which penetrates the volume of the virtual tool (col. 15, lines 20-22).

Claims 22, 23 and 49, Shih et al. does not teach generating an intermediate modified representation; however, Tarr teaches generating an intermediate modified representation (a virtual deformable surface representation; col. 36, lines 21-24); a user motion in 3D space (col. 7, lines 57-63). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate generating an

intermediate modified representation, a user motion in 3D space as taught by Tarr into the sculpting virtual object in a haptic virtual reality environment of Shih's system for modifying the virtual object, because it would provide a method for haptically deforming a virtual surface within a haptic virtual environment is used to plastically deform the virtual surface of a virtual object by sensing a user's position in real space (abstract).

Claims 50 and 51, Shih et al. does not teach transformation modules; however, Tarr teaches at least two of the first, second and third modification, transformation modules are the same module (col. 6, lines 26-45). It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate transformation modules as taught by Tarr into the sculpting virtual object in a haptic virtual reality environment of Shih's system for modifying the virtual object, because using transformation modules, it would determine the user's haptic interface location in haptic interaction space translates the position of the user in real space into a position in haptic interaction space (col. 6, lines 28-29).

10. Claims 57 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shih et al. (6,552,722) in view of Kacyra et al. (5,988,862).

Claims 57 and 58, Shih et al. does not teach the non-volumetric representation comprises a selected one of a point cloud; however; Kacyra et al. teaches the non-volumetric (surface of the virtual object) representation comprises a selected one of a point cloud (col. 3, lines 30-36), a particle system and a collection of curves. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a point cloud as taught by Kacyra into the sculpting virtual object in a

haptic virtual reality environment of Shih's system for modifying the virtual object, because using selected point cloud, the Computer Graphic Perception module would recognize geometric shapes represented by groups of points in the point cloud and generate model that represent these geometric shapes (col. 3, lines 39-43).

Response to Arguments

11. Applicant's arguments filed 5/17/04 have been fully considered but they are not persuasive. Because Shih teaches modifying the non-volumetric representation (see the rejection of claim 1 of this Office Action), a virtual object in Shih has a surface-based representation such as virtual surface 25, isosurface 86, Shih also teaches that "converting the object to an exported surface, such as a polygonal surface" (col. 2, lines 58-59). Shih uses a virtual object (a volumetric representation), converts the virtual object to surface representation, modifying voxel value representative of the voxel based virtual object, isosurface or surface (non-volumetric representation) to produce the new or modified virtual object by using a modification mode: material removal mode, a material addition mode, a smoothing mode, a mirroring mode and a 3D sketch mode; the system also uses a haptic interface location in the haptic virtual environment in response to the location of the user in real space, a virtual tool for use by the user in the haptic virtual environment (user interacting with the virtual object via virtual tool or stimulus); "the user uses the virtual tool in a sculpting mode to modify the shape of the virtual object by adding, removing, or modifying the material of the object (see abstract). Dependent claims 10, 11, 22, 23, 37, 38 and 49-52 are rejected under 35 U.S.C. 103(a)

as being obvious over Shih in view of Tarr, because Tarr teaches a method for haptically deforming a virtual surface (non-volumetric representation) within a haptic virtual environment of a virtual object by sensing a user's position in real-space (see abstract). The motivation to combine the cited references is provided in the references (see this Office Action). For these reasons, the rejections of claims 1-12, 14-39, 41-58 are maintained.

THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimbinh T. Nguyen whose telephone number is (703) 305-9683. The examiner can normally be reached on Monday to Thursday from 7:00 AM to 4:30 PM. The examiner can also be reached on alternate Friday from 7:00 AM to 3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Zimmerman, can be reached at (703) 305-9798. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

July 29, 2004

Kimbinh Nguyen

Patent Examiner AU 2671